

SECTION 1-2

SECTION SUMMARY

Measuring Matter

1

Guide for Reading

- ◆ What is the difference between weight and mass?
- ◆ How is density calculated?

There are many ways to measure matter. Weight and mass are two of them. **Weight** is a measure of the force of gravity on an object. However, the force of gravity is different on every planet. For example, the force of gravity on the moon is less than on Earth, so you would weigh less on the moon than on Earth. The **mass** of an object is the measurement of how much matter it contains. **An object's weight will change if you move it from Earth to the moon or to other planets, but its mass will stay the same.**

Scientists use the **International System of Units** to measure the properties of matter. The system is abbreviated "SI", after its French name, *Système International*. The SI unit for mass is the kilogram (kg). The gram (g) is a smaller unit. There are exactly 1,000 grams in a kilogram. A nickel has a mass of about 5 grams, and the mass of a baseball is about 150 grams.

The amount of space that matter occupies is called its **volume**. Solids, liquids, and gases all have volume. The volume of rectangular objects, such as a block of wood, can be found by multiplying the measurements of length, width, and height. **$\text{Volume} = \text{Length} \times \text{Width} \times \text{Height}$**

When you multiply these measurements, you must multiply the numbers and the units. A common unit of volume is the cubic centimeter (cm³). Other units of volume include the liter (L) and the milliliter (mL). Both are often used for liquids. A milliliter is exactly one cubic centimeter. There are 1,000 milliliters in one liter.

Different substances may have the same mass, but they might not occupy the same volume. An important characteristic property of matter is its density. **Density** is the measurement of how much mass is contained in a given volume. **To calculate the density of an object, divide its mass by its volume.**

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

The units of density are always a unit of mass, such as grams, divided by a unit of volume, such as cubic centimeters. One typical unit of density is written as "g/cm³", which is read as "grams per cubic centimeter." For liquids, density is often given in grams per milliliter, or g/mL.

Sometimes you can compare the densities of solid blocks by observing them. A solid block that sinks in water has a greater density than water. A solid block that floats in water has a lower density than water.

SECTION 1-2**REVIEW AND REINFORCE**

Measuring Matter

◆ Understanding Main Ideas

Use the figure below to answer the following questions. Write your answers on the back of this page or on a separate sheet of paper.

- 1.** What is the volume of the solid in the figure? Show your work.

Be sure to use correct units of measurement.

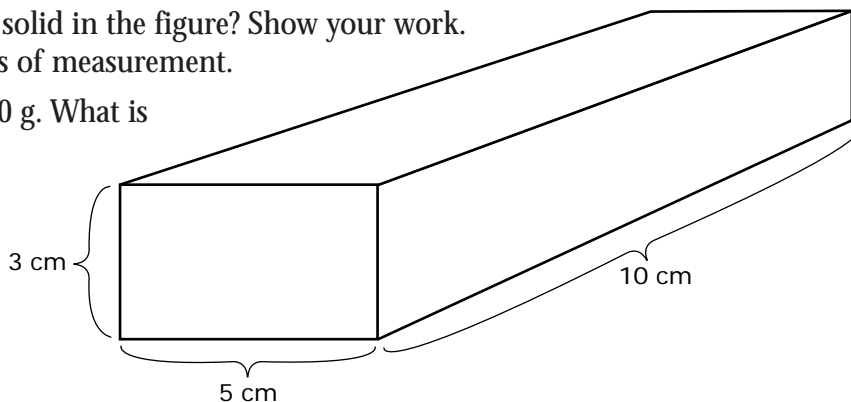
- 2.** The solid has a mass of 180 g. What is the density of the solid?

Show your work. Be sure to use correct units of measurement.

- 3.** Would the above solid have a mass of 180 g on the moon? Would it have the same weight on Earth as on the moon? Explain your answers.

- 4.** The solid above sinks to the bottom when you put it in a container filled with water. What does that tell you about its density?

- 5.** Will every solid with the same dimensions have the same density? Explain your answer.



◆ Building Vocabulary

Write a definition for each of the following terms on the lines below.

- 6.** mass

- 7.** volume

- 8.** density

- 9.** Give two examples of common units for each of the above measurements.
